

Docket No. 529.45588X00
Serial No. 10/558,361
Office Action dated July 13, 2007

REMARKS

By the present amendment, claims 16 and 17 have been introduced for consideration. Accordingly, claims 1-17 are now pending in the application. Claim 1 is independent.

In the Office Action of July 13, 2007, claims 1-3, 6-9, and 12-15 were rejected under 35 USC §103(a) as being unpatentable over U.S. Patent Application Publication No. 2004/0008817 to Nagai, in view of U.S. Patent 5,412,704 Issued to Horbaschek. Claims 1-3, 6-9, and 12-15 were rejected under 35 USC §103(a) as being unpatentable over U.S. Patent Application Publication No. 2004/0174953 to Ikeda et al. ("Ikeda") in view of Horbaschek. Claims 5 and 11 were rejected under 35 USC §103(a) as being unpatentable over Nagai in view of U.S. Patent Application 2002/0057761 to Danielsson. Claims 4 and 10 were rejected under 35 USC §103(a) as being unpatentable over Nagai in view of U.S. Patent 5,602,895 to Fivez. These rejections are respectfully traversed.

Claims 1-3, 6-9, and 12-15 were rejected under 35 USC §103(a) as being unpatentable over Nagai in view of Horbaschek. Regarding this rejection, the Office Action alleges that Nagai discloses an x-ray diagnostic imaging system that includes all the features recited in the claimed invention, except for an x-ray diaphragm setting unit. Horbaschek is relied upon for disclosing this features. Applicants traverse this rejection as follows.

Independent claim 1 defines an x-ray diagnostic imaging system that comprises:

an x-ray irradiation unit for irradiating an object to be examined with x-rays;

an x-ray diaphragm unit disposed in a direction of x-ray irradiation of the x-ray irradiation unit and shielding the irradiated x-

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rays except for the x-rays irradiated on a portion used for obtaining an x-ray image of the object to be examined;

an x-ray diaphragm setting unit for variably setting the x-ray shielded portion to be shielded by the x-ray diaphragm unit;

an x-ray flat panel detector opposed to the x-ray irradiation unit via the object to be examined and imaging x-rays passed through the object to be examined as an x-ray image;

an image processing unit for subjecting the x-ray image obtained by the x-ray flat panel detector to an image processing; and

a display unit displaying the x-ray image subjected to the image processing by the image processing unit, wherein

the image processing unit comprises:

a calculation unit reading out data of an x-ray detection element of the x-ray flat panel detector corresponding to the x-ray shielded portion shielded by the x-ray diaphragm unit which is variably set by the x-ray diaphragm setting unit and calculating a line noise component from the read out data of the x-ray detection element; and

a line noise correction unit correcting a line noise of the x-ray image based on the line noise component calculated by the calculation unit.

According to independent claim 1, the x-ray diagnostic imaging system includes an x-ray diaphragm unit disposed in a direction where the x-ray irradiation unit directs the x-rays to irradiate an object, and shields the irradiated x-rays except for a portion that is used to obtain the x-ray image of the object being examined. An x-ray diaphragm setting unit is provided to variably set the x-ray shielded portion that is to be shielded by the x-ray diaphragm unit. An x-ray flat panel detector is positioned opposite to the x-ray irradiation unit in order to image x-rays that are passed through an object to be examined. The x-ray image obtained by the flat panel detector is processed by the image processing unit and the results are provided to the display unit for displaying the x-ray image of the subject.

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The image processing unit further includes a calculation unit that reads out data of the x-ray detection element in the x-ray flat panel detector corresponding to the x-ray shielded portion that is variably set by the x-ray diaphragm setting unit, and calculates a line noise component from the data read out of the x-ray detection element. Additionally, a line noise correction unit is provided to correct line noise of the x-ray image based on the line noise component calculated by the calculation unit. According to the diagnostic imaging system of Independent claim 1, wider shielded portions are used in order to obtain an increased level of detection data to be used in obtaining the line noise component. Furthermore, the accuracy of the line noise component can be improved due to the availability of additional data for statistical processing.

The Office Action alleges that Nagai teaches various features recited in independent claim 1. This does not appear to be the case. At the outset, Applicants note that reference numeral 22 identifies a collimator used to collimate the irradiated x-rays and improve image clarity. The Office Action alleges that Nagai provides an x-ray shielded portion that is shielded by the x-ray diaphragm unit in the form of invalid area 41. The invalid area, however, is different from the x-ray shielded portion of the instant invention. The invalid area provided in Nagai is used to restrain shading caused by stray signals, and not for correcting the line noise. Nagai clearly indicates that the mask area 42 is utilized to correct and/or reduce line noise. Yet, this mask area is not even mentioned in the Office Action.

The Office Action admits that Nagai fails to disclose an x-ray diaphragm unit for variably setting the x-ray shielded portion to be shielded by the x-ray diaphragm unit. Horbaschek is relied upon for disclosing a variable diaphragm. The Office Action concludes that it would have been obvious to combine the setting unit of

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Nagai with the variable diaphragm of Horbaschek in order to reduce patient overdose. Applicants again disagree.

Horbaschek discloses an x-ray diagnostic device. While the device includes a variable diaphragm, Horbaschek does not provide any disclosure for the additional features that are lacking in Nagai. Furthermore, the Office Action's contention that it would have been obvious to combine the teachings of Horbaschek with the device of Nagai to reduce patient overdose appears to be misplaced. Specifically, the teachings of Horbaschek were readily and widely available to Nagai at the time of filing his invention. Yet there was no attempt at providing a variable diaphragm to reduce patient overdose" as alleged in the Office Action. Notwithstanding this fact, the combination of Nagai and Horbaschek still fails to disclose or suggest all of the features recited in independent claim 1. Consequently, a rejection of obviousness cannot be supported by the references.

It is therefore respectfully submitted that independent claim 1 is allowable over the combination of Nagai and Horbaschek.

The Office Action alternatively rejects claims 1-3, 6-9, and 12-15 under 35 USC §103(a) as being unpatentable over Ikeda et al. in view of Horbaschek.

Ikeda et al. discloses an x-ray diagnostic apparatus that includes, in part, a noise eliminating means for generating noise correction signals from the x-ray signal of two scanning lines adjacent to one another. However, Ikeda fails to disclose calculation of the line noise component using data from the x-ray detection element. Ikeda also fails to provide any disclosure or suggestion for the calculation unit reading out data from the x-ray detection element which corresponds to the x-ray shielded portion of the x-ray diaphragm. Consequently, the combination of Ikeda and Horbaschek still fails to render independent claim 1 obvious.

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It is therefore respectfully submitted that independent claim 1 is allowable over the art of record.

Claims 2-17 dependent from independent claim 1, and therefore believed allowable for at least the reasons set forth above with respect to independent claim 1. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

For example, claim 16 specifies that the visual field of the diaphragm unit is set based on a catheter or guide wire. See paragraph [0054] of the published application. Additionally, claim 17 specifies that the system includes means for performing the line noise correction for a fluoroscopic image using data from the shielded portion. See paragraph [0055].

For the reasons stated above, it is respectfully submitted that all of the pending claims are now in condition for allowance. Therefore, the issuance of a Notice of Allowance is believed in order, and courteously solicited.

If the Examiner believes that there are any matters which can be resolved by way of either a personal or telephone interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

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AUTHORIZATION

Applicants request any shortage or excess in fees in connection with the filing of this paper, including extension of time fees, and for which no other form of payment is offered, be charged or credited to Deposit Account No. 01-2135 (Case: 529.45588X00).

Respectfully submitted,

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